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APPLICATION OF ADJOINT METHODS IN OCEAN MODELING

Ocean models have become an ubiquitous tool for investigating key aspects of oceanic circulation and variability. The progress in this area is impressive, and has, at times, left some complementary aspects of modeling out of focus. Whenever gradient information from models are sought, be it to minimize model vs. observation misfits in state estimation, to investigate sensitivities of key oceanic quantities to a very large number of parameters, or to determine normal or non-normal stability, the adjoint method presents itself as a natural tool for efficiently computing such gradients. We provide an overview of adjoint modeling with the MIT general circulation model (MITgcm). The context of automatic differentiation has enabled us to extend our applications in various directions from coupled ocean-biogeochemical to ocean-seaice modeling, and using various configurations from global coarse-resolution to regional eddy-permitting scales. New developments are discussed, mainly driven by the requirement of a new-generation ECCO ocean state estimation system.

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